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The preferences of public space users as to the introduction of various forms of greenery in the Old Town of Lublin, Poland

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Abstract. Currently, the historical parts of cities are having their functions increasingly oriented towards visitors rather than residents. Their high density of objects of cultural heritage attracts tourists, for whom restaurants and shops are created. Therefore, the management and planning of the historic parts of cities is an increasing challenge. At the same time, activities aimed at improving the quality of life in the city centre, including the most built-up historical parts, require the introduction of greenery (Kowarik, 2019). In order for such spaces to be effective, we require a greater understanding of user preferences. The aim was to define preferences regarding the presence and use of various forms of greenery and their acceptance in the space of the Old Town (the district representing the historical heart of the city). We also asked respondents about the function of greenery in the city. The study was conducted using an online survey in Lublin, Poland. The method of virtual development of four public spaces representing various forms of greenery in a built environment was used. The results should be taken into account by specialists in urban design in historical spaces subject to revitalisation.

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Contents:

1. Introduction

Greenery has been a feature of cities since ancient times (Forrest & Konijnendijk, 2005). The lack of urban greenery was first felt in the Middle Ages (14th–15th centuries), when settlements and cities had a dense structure (Benčat & Supuka, 1988; Haaren, 2020). Tree-lined avenues and parks began to be established and opened to the public in the 18th century, during the industrial revolution. From then on, the number of trees and green areas in cities began to grow. In the 19th century, unused fortifications or old city walls were covered with vegetation in many cities. New functions of green areas were also indicated (recreation, improvement of the physical and moral health of the society) (Haaren, 2020). Nowadays, the percentage of people living in cities is increasing at an accelerated pace (Turner et al., 2004; Grimm et al., 2008; Szymańska, 2007). Some cities develop new plans for densely built-up areas or try to increase the building density of older built-up areas (Jim, 2004). This reduces the land area *per capita* and thus also greenery (James et al., 2009). Most often, building density is highest in the oldest parts of cities. Such are the structures of historical cities, such as those of medieval origin (Mizgajski et al., 2021). This creates numerous functional and spatial problems. At present, the functions of the historic parts of cities are more oriented towards services for visitors than for residents. The high density of cultural heritage sites attracts tourists, and there are many eateries and shops for visitors. Managing and planning the historic parts of cities is proving to be a challenge. Their historic character requires a particularly careful approach to the issue of restoration and establishment of new green areas, which are determined by the type of development. Currently, such areas are often subject to revitalisation treatments (Murzyn, 2006; Starczewski et al., 2022). Such assumptions require the preservation of historical spatial systems, which is supported by undertaking conservation efforts. Revitalisation should primarily concern areas that have the greatest impact on improving the quality of space and creating conditions to satisfy human needs (Freino, 2012). Ameen et al. (2015) drew attention to the advantages of sustainable urban design, which harmoniously combines the protection of historical heritage with the character and spatial arrangement of green areas. Jim (2004) points out that a high density of buildings, regardless of the time of their construction, always requires that more attention be paid to greenery. As urban green spaces are important to satisfy the residents, human preferences are a key criterion. Restoration of these areas' ability to function properly and operate in conjunction with historical solutions should include adapting the entire urban complex to contemporary needs and improving the quality of life of local residents, as well as adapting to intense tourist traffic.

Green areas in Poland are defined by the L*aw on Nature Protection* of 16.04.2004. as:

areas with technical infrastructure and buildings functionally related to them, covered with vegetation, located within the boundaries of villages with compact buildings or cities, performing aesthetic, recreational, health or sheltering functions, in particular parks, greens, promenades, boulevards, botanical, zoological, Jordanian and historic gardens and cemeteries, as well as greenery accompanying streets, squares, historic fortifications, buildings, landfills, airports and industrial railroad facilities.

Their functions have long been subject to scientific study. Urban green spaces have been shown to provide a number of environmental and social benefits relevant to a higher quality of residents' lives (Hartig et al., 2003; Tyrväinen et al., 2005; Nerantzia et al., 2006; Pincetl, 2010; Ignatieva et al., 2011; McPherson et al., 2011; Hofmann et al., 2012; Strohbach & Haase, 2012; Dilley & Wolf, 2013; Camacho-Cervantes et al., 2014; Szymańska et al., 2015; Morgenroth et al., 2016; Dondina et al., 2018; Rudl et al., 2019). Despite their importance, their role has tended to be underestimated in urban planning and management (Baycan-Levent & Nijkamp, 2009). In order to maximise the beneficial effects, residents must be involved in the process of urban greenery planning (Tempesta & Vecchiato, 2015; Gerstenberg & Hofmann, 2016; Dondina et al., 2018; Madureira et al., 2018; Cegielska et al., 2022). In the rich literature on the role of trees and greenery in cities, very little research has focused on the oldest parts of cities. In addition to researching historical parks and gardens (Carrus et al., 2017) and visiting such sites as areas intended for specific activities (Hartig & Kahn, 2016), very little attention has been paid to the greenery preferences in densely built-up areas of a historical nature.

In order to facilitate the activities related to the design of urban greenery in densely built-up areas, more knowledge is needed about various elements of greenery in cities (trees, potted trees, flower beds, vines, lawns) and their potential to perform various functions. We propose a distinction between large-scale urban green spaces and small-scale green spaces. Large-scale greenery (for which a number of studies have been conducted) finds little scope

for development in densely built-up areas, whereas small-scale greenery (which is related to the concept of the compact city), is often preferred by residents and may be sustainable, fulfilling conditions for improving the quality of life in cities.

We conducted the research in Lublin, a city in eastern Poland. In 2020, user preferences related to shaping greenery in densely built-up spaces were tested. The aim was to recognise the general preferences for greenery such as trees, shrubs, plants in pots, in densely built-up spaces. Surveys were carried out on the function of greenery, preferred forms of greenery, and an experiment to choose green forms based on modified images presenting various scenarios for the arrangement of four public spaces in the Old Town.

2. Research materials and methods

Lublin is a medium-sized city in Poland. Within the administrative borders, an estimated 320,000 people live on an area of 147.5 km² (bip.lublin.eu, 2020). The beginnings of settlement in this area date back to the 5th–6th century (Przesmycka, 2012; Kociuba, 2018). City rights were granted in 1317 (Gawarecki, 1974). A few years later, defensive walls were built that determined the shape of the town (Jamiołkowska, 1981; Kociuba, 2018). The city covered an area of 7 ha (Gawarecki, 1974; Kociuba, 2018). The increasing number of inhabitants over time (in the 14th century there were about 2,500 people [Szczygieł, 2017]) made it necessary to increase the building density in the area. This meant that only small clusters of trees were found in the areas of the Dominican and Jesuit monastery and near the castle (Fijałkowski & Kseniak, 1982). Vegetation, including single trees, could be found in yards. In the 17th century, there was no high greenery within the walls, though there was vegetation just beyond them in the monastery gardens. A thorough reconstruction of the city (demolition of part of the fortifications) commenced at the end of the 18th century and introduced trees (Jarzębowski, 1981; Pudelska & Mirosław, 2011; Szczygieł, 2017). Also, the revalorisation of the Old Town in the 19th century and its reconstruction after World War II resulted in the introduction of greenery into city squares, into block interiors, and onto an escarpment threatened by erosion, which was strengthened with vegetation. With time, the greenery was destroyed or restored during renovation and revalorisation works. Currently, the greatest variety of greenery (trees, shrubs, plants in containers, lawns) can be found in backyards. Compared to the Middle Ages, the number of inhabitants in this part of the city is similar, estimated at 2,400. However, there is a visible change of the dominant function from residential and commercial to representative and touristic. Lublin is visited annually by over 1,000,000 people, for whom the oldest part of the city is the main attraction (Mizgajski et al., 2021).

Selecting plants with preferred characteristics may contribute to the satisfaction of users of public spaces (Gwedla & Shackleton, 2019). This knowledge makes it possible to create guidelines for the selection of plants for cities. The identified perceptual criteria used to distinguish green forms allow differences in preferences for green forms in densely built city centres to be identified. Despite knowledge of research showing that people have preferences as to shapes, crown densities, species and colours of flowers (Zhao et al., 2017), their results were not included in the study due to the specificity of historical areas, where the selection of species should be consulted on with specialists: conservators of monuments, landscape architects and ecologists. In the field of urban landscape design, knowledge of green parameters relevant to human perception enables the selection of different forms and species that look similar. The study included deciduous species, which are considered more valuable than conifers (Gerstenberg & Hofmann, 2016), including due to the actual and potential vegetation in Lublin (Trzaskowska, 2013) and historical data on species planted in the past (Fijałkowski & Kseniak, 1982).

In this study, we decided to keep the tree type constant, similarly as in the research by, for example, Lindal and Hartig (2015). The study distinguishes trees only in terms of size (tall trees of over 12 m, medium trees of 9–12 m, short trees of up to 9 m), similar to the studies by Gray and Denke (1978), and no specific species were indicated.

The first part of the survey concerned general information about users, such as gender, age, education and its profile, information on the use of the site (residents, tourists) and specific questions about attitudes and preferences regarding greenery in public spaces. We asked whether there was a need to plant trees in the city and what size the trees should be, whether Lublin and the Old Town had a sufficient amount of greenery, and what functions trees perform in the city. The respondents indicated whether to introduce any forms of greenery or which trees (tall, low) or pots with periodic compositions should be planted in the very centre, in the vicinity of historic buildings.

In the second part, the method of visual evaluation of photographs presenting selected spaces of the Old Town in Lublin was used to

study the preferences for forms of greenery. The photographic presentation allowed desired factors to be highlighted while maintaining constant conditions (e.g., weather, noise). Research conducted using a similar method shows that the use of virtual environments does not lead to significantly different results compared to the use of realistic or real environments (Laing et al., 2009; Kjellgren & Buhrkall, 2010). Photographs have been used as a surrogate for real landscapes (Tveit, 2008). The following places (Pic. 1.) were selected for evaluation: 1. Town Hall, 2. Fish Market, 3. Krakowska Gate, 4. Łokietka Square. They have features commonly found in urban public spaces in the oldest parts of the city centre, i.e. in densely built-up conditions where greenery is lacking or is deliberately limited in order to obtain an area intended for other functions. Moreover, the selection criterion was based on the selection of places where trees were once found (Pudelska & Mirosław 2011) and where there is the potential to introduce greenery in various forms. It should be emphasised that the aim was to examine the acceptability of various forms of greenery in the Old Town space, in the conditions of dense development, and not to select places for plantings to be performed. It is possible to choose other places indicated by specialists for planting.

The selected spaces of the Old Town are shown in the photographs (Pic. 2). Each respondent was asked to enter their preference for one of three images, each of which represented an alternative visualisation of greenery for a given space. Thus, with four spaces and three alternatives for each, a total of 12 images were assessed. Each set consisted of photographs of the current state of development of a certain place onto which three simulations with various forms of greenery had been introduced. The simulations were created using the photomontage technique, using open-source GIMP software (GNU Image Manipulation Program 2.99.4 version). Efforts were made to keep natural colours and distribution of shadows cast by the introduced elements to obtain the most realistic simulation.

Photographs showing the current state of the selected spaces were taken under the same conditions. To control the effect of light on the quality of the photos, all photos were taken on the same spring day from 11.00 to 12.00 a.m. The observer's point of view was constant and the same in each set, placed at eye level (about 1.6 m above the ground). This made it possible to obtain an effect similar to the situation in which respondents observe the space from the perspective as if they were standing in a square of a given interior.

The first simulation of the selected sites included large trees planted directly in the ground. Because the Old Town is a densely built-up space into which large trees (over 12 m) cannot be introduced, medium trees were assumed here according to Gray and Denke (1978). They are 10 m high in our visualisations. Native species of deciduous trees were selected, as they are resistant to harsh urban

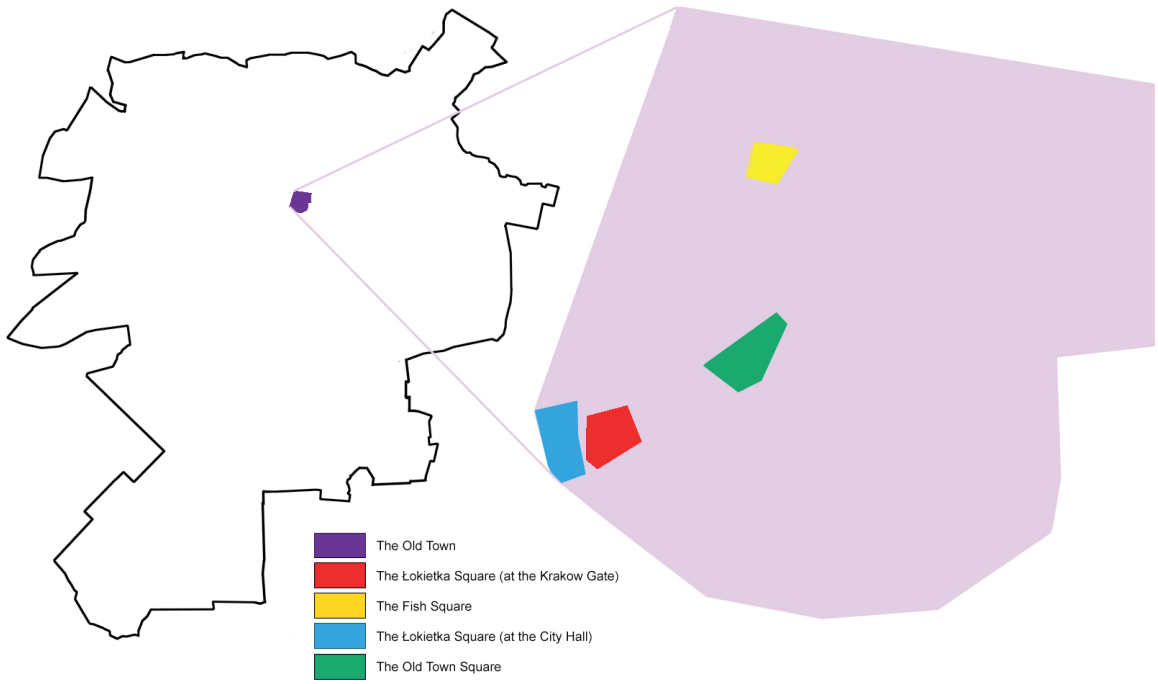

Fig. 1. Research area
Source: authors'

Fig. 2. Photos of four city squares in Lublin, with simulations of various forms of greenery
Source: authors'

conditions and thus often used in plantings. The second of the photomontages showed the same spaces with green in the form of containers with flowering plants. The style and form of flowerbeds were chosen that are most often used in Lublin. These are catalogue, concrete pots planted with seasonally flowering plants (geraniums, petunias, begonias, etc.). The third simulation included small trees grafted onto a trunk (2–5m) and planted in large pots. Such trees are used in Lublin as urban plantings and considered to be the equivalent of tall greenery in the city centre (Mizgajski et al., 2021).

The survey was pilot-tested on 15 people, including academic peers and the general public. Investigative interviews were conducted during the tests to identify any difficulties in answering or understanding the questions, and the course of the survey. After making corrections, the research was carried out with forms made available via the Internet on thematic groups related to Lublin on Facebook. Before joining the groups, users declared their relationship with the city through knowledge of public spaces, both as residents and tourists. The online form of collecting information resulted from restrictions related to the pandemic, including recommendations for movement and gathering in groups. The surveys were published in May 2020 and were available until November 2020. Participation in the surveys was voluntary, and access to the survey link was open to the public. Two hundred and seventy-four people took part in the research. Twenty-seven questionnaires were not taken into account due to their being incorrectly filled. Ultimately, the responses of 247 people were analysed.

Of the 247 people, 22% were male and 75% female. A low response rate does not necessarily mean that it is unrepresentative, although it seems that our trial had a greater percentage of women than in the general population for the obtained age range, speaking of auto-selection operation. Nevertheless, we had considerable variability in the sample, which is reflected, for example, in its age range. Our photos with visualisations were assessed by a heterogeneous group of people, similar to the research by Lindal and Hartig (2015). Among them, four age groups can be distinguished: 24% - 45+, 32% - 35–44, 25% -25–34, 19% - 18–24. The majority, 66% of people, declared a higher education and 34% declared a secondary education. People declared different education profiles: 30% of people indicated natural sciences, 28% humanities, 27% technical, 21% artistic, 18% general education, 5% medical. Multiple choice was possible. Due to the high frequency of selecting many education profiles at the same time and errors in their nomenclature, only two groups were taken into account. The first one is made up of combined natural and artistic specialisations, due to their occurrence in over 90% together, and the second one consists of other profiles (OTHER). With this distribution, group 1 accounts for 41.1% of all survey participants, and group 2 for 59.9%. The majority (77%) described Lublin as their main place of residence.

All statistical analyses were performed using IBM SPSS Statistics for Windows, Version 26.0. (IBM Corp, Armonk, NY, USA). Pearson's chi-square test (Chi-square Test for Independence) was used to test for associations between categorical variables. A P-value of $p<0.05$ was considered statistically significant and all tests were two-tailed.

3. Research results

3.1. Preferences regarding Lublin's greenery

Research shows that all respondents are in favour of planting trees in the city (100%). Regardless of the diversity of socio-demographic characteristics, the majority believe that these should be large (64%) and medium-sized (31%) trees. The respondents indicate an insufficient amount of greenery in Lublin (82%), including too little greenery in the Old Town (92%) and the need to plant trees within it (88%).

3.2. Preferences concerning the shaping of greenery in the densely built-up historical cities and the functions performed by greenery

The distribution of answers regarding preferred sizes of trees differ between the city more widely and the historic district of the Old Town – almost half of the respondents believe that medium-sized trees (48%) should be introduced to the Old Town, whereas 31% of respondents support low, grafted species. On the other hand, a sizeable minority is in favour of planting tall trees (22%). With regard to the Old Town, more women (33.73%) are in favour of planting low, grafted trees, while men believe that, after the preferred medium trees, the second group should be large trees (29.79%). However, these differences are not significant.

Medium-sized trees for the Old Town space are preferred by all age groups. The specific rank orders of other types (large and low) vary. The situation is similar in the ranges by level and profile of

education, although the following descending order of preference is chosen more often: medium–low–high trees (group with higher education, education with a natural and artistic profile and others, people from Lublin) followed by the order: medium–high–low trees (the group with secondary education and the group of people from outside Lublin).

As for the forms of greenery that should be introduced to the Old Town, most respondents selected: pots with flowering plants (66.4%), trees planted in the ground (60%), pots with shrubs (54%) and shrubs planted in the ground (53%). Nearly half selected pots with trees (46%), flowering herbaceous plants in the ground (43%) and built stands containing plants (43%). There was less interest in introducing lawns (29%) and climbing plants (2.4%). Women more often indicated flowering plants in pots (67%) than trees in the ground (58.2%). Among men, these plant forms were chosen almost equally often (64.15% and 64.10%). Flowering plants in pots were also highly appreciated by younger age groups (up to 44 years of age). Only in the 45+ group were bushes in the ground preferred first (61.66%), followed by trees in the ground and flowering plants in pots (60% each). The choices made seem to be unaffected by education or place of residence.

Among the responses regarding the functions of greenery in the city, the dominant ones were: climatic (92%), ecological (91%) and aesthetic (90%). Retention (57%) and social (56%) functions were chosen less often and, very rarely, compositional functions (0.8%). Among women, climatic (92.26%), ecological (91.23%) and aesthetic (91.75%) functions were chosen almost equally often, while among men's choices the ecological function (96.56%) prevailed over the climatic (90.56%) or aesthetic (86.79%).

3.3. Preferences regarding the greenery of the Old Town based on visualisation

The conducted research allowed us to determine the preferences of the users of Lublin's public spaces regarding the choice of forms of greenery for the densely built-up Old Town district. The respondents assessed three proposed variants for four different representative spaces. These were places within Lublin's Old Town, such as Łokietka Square (at the Krakow Gate), Łokietka Square (at the Town Hall), the Old Town Square and the Fish Square. The variants differed in the forms of vegetation presented.

Table 1. Assessment of visualisation at Łokietka Square (part at the Krakow Gate)

Variables	*Preferred green solutions in the Old Town of Lublin*				
	Variant 1 large tree	**Variant 2** flowering herbaceous potted plants	**Variant 3** potted tree	**Total**	**Statistics**
Women	101	18	76	195	**6.710 p=0.035**
	51.8%	9.2%	39.0%	100.0%	
Men	35	0	18	53	
	66.0%	0.0%	34.0%	100.0%	
age: 18–24	21	3	22	46	8.185 p=0.225
	45.7%	6.5%	47.8%	100.0%	
age: 25–34	37	4	22	63	
	58.7%	6.3%	34.9%	100.0%	
age: 35–44	49	3	27	79	
	62.0%	3.8%	34.2%	100.0%	
age: 45+	29	8	23	60	
	48.3%	13.3%	38.3%	100.0%	
Higher education	89	7	67	163	**7.045 p=0.030**
	54.6%	4.3%	41.1%	100.0%	
Secondary or lower education	47	11	27	85	
	55.3%	12.9%	31.8%	100.0%	
Place of residence: Lublin	101	13	75	189	1.105 p=0.575
	53.4%	6.9%	39.7%	100.0%	
Place of residence: outside Lublin	35	5	19	59	
	59.3%	8.5%	32.2%	100.0%	
Employed	31	8	23	62	3.997 p=0.136
	50.0%	12.9%	37.1%	100.0%	
Unemployed	105	10	71	186	
	56.5%	5.4%	38.2%	100.0%	
Financial situation: difficult / very difficult	14	4	9	27	3.496 p=0.479
	51.9%	14.8%	33.3%	100.0%	
Financial situation: moderate	60	8	47	115	
	52.2%	7.0%	40.9%	100.0%	

Table 1 continiued

Financial situation: very good / good	62	6	38	106	
	58.5%	5.7%	35.8%	100.0%	
Education: other than arts	107	15	74	196	0.217 p=0.897
	54.6%	7.7%	37.8%	100.0%	
Education: arts	29	3	20	52	
	55.8%	5.8%	38.5%	100.0%	
Education other than tech	100	13	67	180	0.143 p=0.931
	55.6%	7.2%	37.2%	100.0%	
Education: tech	36	5	27	68	
	52.9%	7.4%	39.7%	100.0%	
Education other than nature	92	11	69	172	1.487 p=0.475
	53.5%	6.4%	40.1%	100.0%	
Education: nature	44	7	25	76	
	57.9%	9.2%	32.9%	100.0%	
Other than humanities	96	14	70	180	0.684 p=0.710
	53.3%	7.8%	38.9%	100.0%	
Education: humanities	40	4	24	68	
	58.8%	5.9%	35.3%	100.0%	

Variables Preferred green solutions in the Old Town of Lublin
Source: own elaboration

With visualisation 1 (Table 1), in both the women's and men's groups, the majority indicated a large tree as the most appropriate solution for the space at Krakow Gate, but men were far more likely to indicate this. At the same time, they did not choose the variant with flowering herbaceous plants in pots, and a smaller proportion of them indicated small trees in pots. Based on the results, it can be concluded that:

1. Gender influences the choice of design solution in public space.
2. Men more often than women prefer tall green areas in public spaces.

Among respondents with higher education, more than half chose option 1, slightly less than half chose option 3, and by far the fewest people chose option 2. Among respondents who had a high school education or less, option 1 was the most popular, followed by option 3, with the fewest votes cast for option 2. The variant with a large tree in public space obtained the highest marks in both groups. Both people with higher, secondary and low education chose them most often and equally often. Small trees in pots were rated highly, but were indicated more often by people with higher education. In the case of flowering herbaceous plants in pots, they were much more often chosen by people with lower education. Based on the results, it can be concluded that:

1. Education influences the choice of a design solution in public space.
2. People with lower education more often prefer flowering herbaceous plants in public space.

In the evaluation of visualisation 2 (Table 2), in both the women's and men's groups, more than half of the people chose option 1, while options 2 and 3 were chosen less frequently. The relationship with the first variant is particularly visible, where men much more often than women chose a large tree as a suitable solution in the space in Plac Rybny. At the same time, few pointed to the variant with flowering herbaceous plants in pots. Based on the results, it can be concluded that:

1. Gender influences the choice of design solution in public spaces.
2. Men more often than women prefer tall green areas in public spaces

The respondents, regardless of their age, most often chose the variant with a large tree, and the lowest percentage, compared to other variants, is visible in the group over 45 years of age. This group also indicated solutions with flowering herbaceous plants in pots and trees in pots far more often than all other age groups. This group also has the greatest uniformity of assessments. Based on the results, it can be concluded that:

1. Age influences the choice of solutions in public space.
2. People over 45 prefer tall greenery in public space less often than do people from younger age groups.

Taking into account the material situation, the variant of the photo with a large tree was most often chosen in three groups: among those with a good or very good situation, a moderate situation and a severe or very severe situation. People with a moderate financial situation much more often indicated a solution such as a pot with herbaceous plants. Small trees in pots were more often voted for by people with a good or very good financial

Table 2. Assessment of the visualisation of Rybny Square

Variables	*Preferred green solutions in the Old Town of Lublin*				
	V1	**V2**	**V3**	**Total**	**Statistics**
Women	116	35	44	195	**6.938 p=0.031**
	59.5%	17.9%	22.6%	100.0%	
Men	39	2	12	53	
	73.6%	3.8%	22.6%	100.0%	
age: 18–24	30	7	9	46	**14.956 p=0.021**
	65.2%	15.2%	19.6%	100.0%	
age: 25–34	43	5	15	63	
	68.3%	7.9%	23.8%	100.0%	
age: 35–44	56	10	13	79	
	70.9%	12.7%	16.5%	100.0%	
age: 45+	26	15	19	60	
	43.3%	25.0%	31.7%	100.0%	
Higher education	108	20	35	163	3.571 p=0.168
	66.3%	12.3%	21.5%	100.0%	
Secondary or lower education	47	17	21	85	
	55.3%	20.0%	24.7%	100.0%	
Place of residence: Lublin	122	27	40	189	1.454 p=0.483
	64.6%	14.3%	21.2%	100.0%	
Place of residence: outside Lublin	33	10	16	59	
	55.9%	16.9%	27.1%	100.0%	
Employed	40	11	11	62	1.352 p=0.509
	64.5%	17.7%	17.7%	100.0%	
Unemployed	115	26	45	186	
	61.8%	14.0%	24.2%	100.0%	
Financial situation: difficult / very difficult	20	2	5	27	**11.049 p=0.026**
	74.1%	7.4%	18.5%	100.0%	
Financial situation: moderate	70	25	20	115	
	60.9%	21.7%	17.4%	100.0%	
Financial situation: good / very good	65	10	31	106	
	61.3%	9.4%	29.2%	100.0%	
Education: not arts-related	117	31	48	196	3.191 p=0.203
	59.7%	15.8%	24.5%	100.0%	
Arts education	38	6	8	52	
	73.1%	11.5%	15.4%	100.0%	
Education: not tech related	111	27	42	180	0.241 p=0.887
	61.7%	15.0%	23.3%	100.0%	
Tech education	44	10	14	68	
	64.7%	14.7%	20.6%	100.0%	
Education: not nature related	97	31	44	172	**9.209 p=0.010**
	56.4%	18.0%	25.6%	100.0%	
Nature related	58	6	12	76	
	76.3%	7.9%	15.8%	100.0%	
Education: Other than humanities	112	26	42	180	0.272 p=0.873
	62.2%	14.4%	23.3%	100.0%	
Education: humanities	43	11	14	68	
	63.2%	16.2%	20.6%	100.0%	

Source: own elaboration
(V1 - big tree, V2 - flowering herbaceous V3 - potted tree)

situation. Based on the results, it can be concluded that:

1. Material situation affects the choice of design solutions in public spaces.
2. People with a moderate financial situation more often prefer flowering herbaceous plants in public spaces

Analysis of the education aspect shows that, irrespective of education, respondents gave the variant with a large tree the highest marks, which was indicated much more often by people associated with nature. People without a natural education much more often indicated solutions with herbaceous plants in pots and small trees in pots. Based on the results, it can be concluded that:

1. A nature-related educational profile influences the choice of design solutions in public spaces.
2. People without a nature-related education more often prefer flowering herbaceous plants and small trees in pots in public spaces.

In the evaluation of visualisation 3 (Table 3) (in both the women's and men's groups), the majority of people chose option 1, with men choosing it far more often than women, indicating a large tree as an appropriate solution for the space near the Town Hall. At the same time, they very rarely chose the variant with flowering herbaceous plants in pots, and the proportion of them who indicated small trees in pots was smaller than the analogous proportion of women. Based on the results, it can be concluded that:

1. Gender influences the choice of design solution in public spaces.
2. Men more often than women prefer tall green areas in public spaces.

The first variant with a large tree at the Town Hall was most often chosen in all four age groups. Its percentage was lower than all other variants in the group over 45 years of age. This group also indicated solutions with trees in pots far more often than did other age groups, and flowering herbaceous plants in pots slightly more often. This group also has the greatest uniformity assessments. Based on the results, it can be concluded that:

1. Age affects the choice of design solutions in public spaces.

2. People over 45 years of age less often prefer tall greenery in public spaces than people in younger age groups.

In terms of living in the group of Lublin residents, 59.8% chose option 1, 5.3% chose option 2, and 34.9% chose option 3. Among people from outside Lublin, 64.4% chose option 1, 13.6% chose option 2, and 22% chose variant 3. Both groups chose the first variant with a large tree near the Town Hall most often. However, people from outside Lublin indicated this solution more often than locals, as was the case with potted flowering herbaceous plants. On the other hand, trees in pots were mentioned more often by people living in Lublin. Based on the results, it can be concluded that:

1. Place of residence affects the choice of design solutions in public spaces.
2. People from outside Lublin prefer flowering herbaceous plants in public spaces more often than do city residents.

In the evaluation of visualisation 4, taking into account the age parameter, the results were distributed as follows:

The first variant with a large tree in the Old Town Square was most often chosen in the three age groups over 25 years of age. Only the group of people aged 18–24 indicated option 3 most often. The group preferred the option with trees in pots. Based on the results, it can be concluded that:

1. Age affects the choice of design solutions in public spaces.
2. People over 25 years of age more often prefer tall green areas in public spaces than do people from younger age groups.

The analysis of the employment aspect shows that working people most often chose small trees in pots, while among those who did not work, the most frequently indicated variant was a large tree. Based on the results, it can be concluded that:

1. Employment status affects the choice of design solution in public spaces.
2. All respondents indicated the first and third options, though those not in employment preferred large trees, while those in work preferred low trees.

Based on the research results, it can be concluded that gender and age have the greatest impact on user preferences. These factors were found to have an influence in three out of four photos and were

Table 3. Assessment of the visualisation in Łokietka Square (part by the Town Hall)

Variables	*Preferred green solutions in the Old Town of Lublin*				
Variables	**Variant 1** large tree	**Variant 2** flowering herbaceous plants in pots	**Variant 3** short tree	**Total**	**Statistics**
Women	111	17	67	195	**6.830 p=0.033**
	56.9%	8.7%	34.4%	100.0%	
Men	40	1	12	53	
	75.5%	1.9%	22.6%	100.0%	
age: 18–24	30	4	12	46	**18.749 p=0.005**
	65.2%	8.7%	26.1%	100.0%	
age: 25–34	41	1	21	63	
	65.1%	1.6%	33.3%	100.0%	
age: 35–44	56	6	17	79	
	70.9%	7.6%	21.5%	100.0%	
age: 45+	24	7	29	60	
	40.0%	11.7%	48.3%	100.0%	
Higher education	100	13	50	163	0.562 p=0.755
	61.3%	8.0%	30.7%	100.0%	
Secondary or lower education	51	5	29	85	
	60.0%	5.9%	34.1%	100.0%	
Place of residence: Lublin	113	10	66	189	**6.737 p=0.034**
	59.8%	5.3%	34.9%	100.0%	
Place of residence: outside Lublin	38	8	13	59	
	64.4%	13.6%	22.0%	100.0%	
Employed	37	3	22	62	1.028 p=0.598
	59.7%	4.8%	35.5%	100.0%	
Unemployed	114	15	57	186	
	61.3%	8.1%	30.6%	100.0%	
Financial situation: difficult / very difficult	16	2	9	27	0.440 p=0.979
	59.3%	7.4%	33.3%	100.0%	
Financial situation: moderate	68	9	38	115	
	59.1%	7.8%	33.0%	100.0%	
Financial situation:	67	7	32	106	
Financial situation: good / very good	67	7	32	106	
	63.2%	6.6%	30.2%	100.0%	
Education: not arts-related	112	16	68	196	5.573 p=0.062
	57.1%	8.2%	34.7%	100.0%	
Art education	39	2	11	52	
	75.0%	3.8%	21.2%	100.0%	
Education: not tech-related	108	15	57	180	1.138 p=0.566
	60.0%	8.3%	31.7%	100.0%	

Table 3 continiued

Financial situation: good / very good	67	7	32	106	
	63.2%	6.6%	30.2%	100.0%	
Education: not arts-related	112	16	68	196	5.573 p=0.062
	57.1%	8.2%	34.7%	100.0%	
Art education	39	2	11	52	
	75.0%	3.8%	21.2%	100.0%	
Education: not tech-related	108	15	57	180	1.138 p=0.566
	60.0%	8.3%	31.7%	100.0%	
Tech education	43	3	22	68	
	63.2%	4.4%	32.4%	100.0%	
Education: not nature-related	102	12	58	172	0.906 p=0.636
	59.3%	7.0%	33.7%	100.0%	
Nature-related education	49	6	21	76	
	64.5%	7.9%	27.6%	100.0%	
Education: Other than humanities	112	14	54	180	1.146 p=0.564
	62.2%	7.8%	30.0%	100.0%	
Education: humanities	39	4	25	68	
	57.4%	5.9%	36.8%	100.0%	

Source: own elaboration

statistically significant. Education, place of residence, education profile, employment and financial situation appeared as factors individually influencing the choice. There was no clear relationship between these factors.

4. Discussion

Research has shown that vegetation is an important landscape feature offering many benefits to humans and the environment. This is of particular importance in cities, where it is becoming a rarer feature (Rudl et al., 2019), as has been indicated in Lublin. Due to the compaction trends in Western cities, large green spaces are a finite resource. Small public urban green spaces and even individual forms of greenery can contribute to satisfying the need for everyday outdoor experiences and create opportunities for sustainable city management if development practices take into account the improvement of the quality of life (Kabisch & Haase, 2014). It is important to increase the availability of green areas. Baur and Tynon (2010) suggest that small-scale green spaces may be areas that contribute to health and wellness. Trees are considered to be the key elements of greenery (Dondina et al. 2018), as confirmed by research in Lublin. According to

Table 4. Assessment of visualisation on the Old Town Square

Variables	*Preferred green solutions in the Old Town of Lublin*				
	V1	**V2**	**V3**	**Total**	**Statistics**
Women	96	27	72	195	2.973 p=0.238
	49.2%	13.8%	36.9%	100.0%	
Men	33	5	15	53	
	62.3%	9.4%	28.3%	100.0%	
age: 18–24	13	12	21	46	**18.761 p=0.005**
	28.3%	26.1%	45.7%	100.0%	
age: 25–34	35	5	23	63	
	55.6%	7.9%	36.5%	100.0%	
age: 35–44	50	6	23	79	
	63.3%	7.6%	29.1%	100.0%	
age: 45+	31	9	20	60	
	51.7%	15.0%	33.3%	100.0%	
Higher education	90	21	52	163	2.305 p=0.316
	55.2%	12.9%	31.9%	100.0%	
Secondary or lower education	39	11	35	85	
	45.9%	12.9%	41.2%	100.0%	
Place of residence: Lublin	97	27	65	189	1.358 p=0.507
	51.3%	14.3%	34.4%	100.0%	
Place of residence: outside Lublin	32	5	22	59	
	54.2%	8.5%	37.3%	100.0%	
Employed	22	10	30	62	**9.183 p=0.010**
	35.5%	16.1%	48.4%	100.0%	
Unemployed	107	22	57	186	
	57.5%	11.8%	30.6%	100.0%	
Financial situation: difficult / very difficult	10	5	12	27	4.774 p=0.311
	37.0%	18.5%	44.4%	100.0%	
Financial situation: moderate	58	13	44	115	
	50.4%	11.3%	38.3%	100.0%	
Financial situation: good / very good	61	14	31	106	
	57.5%	13.2%	29.2%	100.0%	
Education: not arts-related	106	25	65	196	1.762 p=0.414
	54.1%	12.8%	33.2%	100.0%	
Arts education	23	7	22	52	
	44.2%	13.5%	42.3%	100.0%	
Education: not tech-related	100	24	56	180	4.624 p=0.099
	55.6%	13.3%	31.1%	100.0%	
Tech education	29	8	31	68	
	42.6%	11.8%	45.6%	100.0%	
Education: not nature-related	90	22	60	172	0.022 p=0.989
	52.3%	12.8%	34.9%	100.0%	
Nature-related education	39	10	27	76	
	51.3%	13.2%	35.5%	100.0%	
Education: Other than humanities	92	23	65	180	0.310 p=0.856
	51.1%	12.8%	36.1%	100.0%	
Education: humanities	37	9	22	68	
	54.4%	13.2%	32.4%	100.0%	

Source: own elaboration
(V1 - large tree, V2 - flowering herbaceous plants in pot V3 - short tree)

Zhao et al. (2017), they are important because, as they dominate the landscape, they determine the attractiveness of the place. Research on the acceptance of trees in cities shows that they are positively perceived by residents (Flannigan, 2015; Gwedla & Shackleton, 2019). Spaces with trees are preferred over those with inanimate objects (Todorova et al., 2004; Lohr & Pearson-Mims, 2006; Gerstenberg & Hofmann, 2016; Dondina et al., 2018). People also point out that more trees should be planted in cities (Camacho-Cervantes et al., 2014; Rudl et al., 2019). Our research also confirms such opinions.

One of the important aspects of the research is changing climatic conditions. Plants are of great importance for improving cities' climates (Dilley & Wolf, 2013; Morgenroth et al., 2016; Dondina et al., 2018; Rudl et al., 2019); hence, their presence is becoming extremely important, especially in the most built-up parts. In our research, the climatic function of trees was a leading function. On the other hand, changing conditions mean that plants that once did well in urban areas will not necessarily grow well today. When selecting species for urban areas, one should take into account the possibility of their adaptation to environmental conditions, functions and low costs of production, planting and maintenance (Sćbø et al., 2005; Dondina et al., 2018).

In addition to their positive impact on the quality of the environment, plants contribute to improving the aesthetics of cities (Sćbø et al., 2005; Tyrväinen et al., 2005; Ignatieva et al., 2011; McPherson et al., 2011; Dilley & Wolf, 2013), and visual attractiveness is one of the highest-rated benefits of trees (Flannigan, 2015). Due to their seasonal variability, trees provide colour and have various shapes, textures and densities (Tyrväinen et al., 2005). They soften the perception of the urban landscape (Dondina et al., 2018), dominate open spaces, and frame views (Tyrväinen et al., 2005). More trees and the presence of flowers in urban landscapes are in line with people's preferences (Lindal & Hartig, 2015). In the research carried out in Lublin, the aesthetic function of greenery was considered to be important, and the greatest preferences for colourful flowers were shown by women. Flowering plants used in cities are considered a clear sign of strong management (Hofmann et al., 2012; Arnberger & Eder, 2015).

In our research, one of the most frequently chosen ones by the respondents was the ecological function (apart from the climatic and aesthetic functions). It is very important in practice, especially when the urban environment around the world is facing many problems such as the occurrence of heat islands, loss of biodiversity, and air and water pollution. Therefore, when selecting trees for cities, their ecological effects should be taken into account. However, what is the relationship between the aesthetic values and ecological benefits of the selected forms of greenery? Can we combine these two goals at the same time? What should we do to mitigate negative influences when aesthetic preferences go against ecological goals, such as choosing plants in pots? Knowing about tree parameters relevant to human perception makes it possible to select different species that look similar and thus create an overall picture of the preferred forms of greenery. The use of a variety of trees to match this image allows one to increase the diversity of plants in the urban space. In addition, the selection of trees with preferred traits may contribute to an increase in residents' satisfaction (Gerstenberg & Hofmann, 2016; Dondina et al., 2018; Madureira et al., 2018). It should be acknowledged that social research into urban areas is generally separated from its ecological component (Turner et al., 2004). It should be remembered, however, that while general preferences seem to lead to the selection of similar urban green structures, they may differ when analysing, for example, green features that allow for an effective improvement of climatic conditions (Ebenberger & Arnberger, 2019). Therefore, authors like Velarde et al. (2007) indicate that, taking into account the gaps in the literature on specific physical attributes that improve the quality of the environment, it is worth continuing research in this area.

Research on users' preferences for public spaces is important and should be taken into account in the design process (Hofmann et al., 2017; Zhao et al., 2017; Gwedla & Shackleton 2019). With regard to trees, many of them indicate a preference for large and tall forms (Schroeder et al., 2006; Camacho-Cervantes et al., 2014; Gerstenberg & Hofmann, 2016; Dondina et al., 2018; Rudl et al., 2019). Research on shapes shows that trees with wide, branchy or spherical crowns are considered better, while narrow, conical crowns are less well rated (Lohr & Pearson-Mims, 2006; Hofmann et al., 2017; Zhao et al., 2017). In addition, people prefer trees with large crowns and short trunks (Summit & Sommer, 1999; Gerstenberg & Hofmann 2016). Dense crowns (Gerstenberg & Hofmann, 2016; Zhao et al., 2017) and deciduous forms (Camacho-Cervantes et al., 2014; Gerstenberg & Hofmann 2016; Hofmann et al., 2017) are also more valued. According to these results, it is the large trees with wide crowns presented in the visualisations that were the most frequently chosen form of greenery

for the Old Town in our research. However, it seems that also, in accordance with the preferences regarding the shape of crowns in historic parts of cities in Poland, grafted maples and spherically crowned black locusts (*Robinia pseudoacacia*) are currently planted (Mizgajski et al., 2021). In the conducted research, such forms were very popular in the selections of women and the oldest age group.

The Old Town is a historic part of Lublin, and therefore it is important that the valuable buildings located here are properly displayed. Campagnaro et al. (2020), researching the historical part of Padua, claim that historical heritage is worth associating with greenery. Bell et al. (2005), however, note that the introduction of trees can sometimes reduce the aesthetic quality of the surroundings, obscuring beautiful facades or particularly attractive views. Perhaps for this reason, medium and small trees were the preferred form in the responses to our text questions from the first part of the survey. It is not certain, however, that the choices made in the lower forms resulted from the possibility of monuments being obscured. It is worth testing this aspect.

Research on preferences in the perception of greenery shows that preferences regarding it are varied and depend on many factors, including gender, age, cultural and geographical origin, education, and wealth of the society (Svobodova et al., 2012; Gerstenberg and Hofmann, 2016), while Strumse (1996) emphasises that differences between demographic groups in the assessment of landscape should not be ignored. The relationship between gender and age preferences was also clearly visible in our research. Women perceive and appreciate the aesthetic value of green areas more than men (Sang et al., 2016; Braçe et al., 2021). According to this view, it was women who more often than men chose small trees in pots and flowering herbaceous plants in pots, which are organised, symmetrical, colourful forms and have an impact on the visual quality of the space. According to Wang and Zhao (2019) and Zhao et al. (2017), flowering plants always score highly in the landscape, while Todorova et al. (2014) state that they are the form of greenery second most often chosen, after trees, for urban street plantings.

Age was another factor that clearly influenced the choice of greenery forms. People over 45 preferred tall trees less often than other groups but more often showed a liking for smaller forms. This attitude is confirmed by the research by Gwedl and Shackleton (2019), who write that the street trees they describe that were appreciated by middle-aged people were less often preferred by older people. Flannigan (2005) argues that the noticeable decline in positive opinions about trees in the older age group may be related to the more frequent perceived nuisance associated with them (e.g., leaf shedding), with which older people cope less well. On the other hand, Arnberger and Eder (2011) state that, with age, people's preferences for natural greenery decline in favour of ordered greenery. The choices of such forms of greenery are also visible in the elderly from our study.

The results of surveys of landscape preferences often indicate that perception is clearly influenced by the age and gender of the respondents (Todorova et al., 2004; Wang & Zhao, 2017; Liu et al., 2021), while other variables such as differences in income, education and current place of residence do not affect the results in a way that could be considered statistically significant (Liu et al., 2021). This is consistent within our findings. The research conducted in Lublin showed that people's preferences regarding forms of greenery may be affected by factors such as employment, education, material status or place of residence, but the choices made in these aspects are single and unreliable and therefore require further research. Their results show some agreement with the studies of other authors. Colley et al. (2015) study the impact of employment on the perception of greenery and indicate the connection between the well-being of working people and greenery.

The possibility of using green spaces during work, or even a view of greenery from the windows overlooking trees, lawns, shrubs or flowering plants, is conducive to well-being. Kaplan (2007) also writes about this, claiming that a view of trees is of particular importance. Also in our research, employed people indicated a tree as the preferred form of greenery, although it was a small tree in a pot.

Wang and Zhao (2017), Molnarova et al. (2012) and Yu (1995) state that the perception of landscape is influenced by the level of education. Wang and Zhao (2017) in their study showed that the most educated people prefer vegetation with a high level of naturalness, which affects ecological importance. In our study, people with higher education most often chose large trees and trees in pots, while people with lower education chose large trees and flowering plants. Such choices may be related to the environmental awareness acquired along with education.

Similar studies of landscape preferences also show the dependence of perception on cultural differences between residents and tourists (Todorova et al., 2004), although Yu (1995) claims that. in his research, these differences do not significantly influence the choices made. However, in the case of

Lublin, we surveyed the opinions of residents and visitors, disregarding cultural background, so we cannot compare the results obtained.

5. Conclusions

The research revealed Lublin residents' opinion about greenery, as well as their preferences regarding the forms of greenery used in the historic, densely built-up part of the city. General opinions about trees confirm that they are a scarce but desirable element in the city, and that their most important functions include climatic, ecological and aesthetic functions. The importance of greenery is particularly important in areas of dense development, where there is no space for it to be shaped freely and thus its environmental impact is insufficient.

Our research confirms that the size and type of greenery are important for people. Thus, these features should be taken into account in planning and designing urban green areas, including among historical buildings. Trees were the preferred form of greenery in the historic buildings of the Old Town. Large trees were considered to be the most appropriate. The differences in the results we got for this type of greenery may be due to a misunderstanding of the term "big tree". Hence, we consider it valuable to study with the use of virtual images, which eliminates these errors resulting from misconceptions of the studied plant forms. The obtained results also show that the proposed tree sizes, with appropriate location, do not diminish the value of historic buildings.

Smaller forms of greenery in pots (spherical grafted trees, flowering herbaceous plants) were also often appreciated. Given that the opinions of all users should be taken into account in order to ensure satisfaction with greenery, these forms should not be ignored in future planning and design of space.

The conducted research allowed us to obtain users' preferred image of the greenery of the Old Town in Lublin. Such results should be taken into account in the design and planning of green areas in historical parts of cities. This is all the more important because the changing function of old cities from residential to representative is making it also important to improve their image, which may be helped by the appropriate shaping of greenery.

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